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URINARY BLADDER, WITH OBSERVA-
TIONS ON DIAGNOSIS.

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**REPORT OF SEVEN CASES OF RUPTURE OF
THE URINARY BLADDER, WITH OBSERVA-
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OF the following cases, I myself saw the first three and assisted in their treatment. I am indebted for the privilege of reporting these three to Drs. T. J. Conley, Bayard Holmes, and C. W. Earle, in whose hospital or private practices they occurred. Dr. Henry F. Lewis furnished me with the facts concerning Case IV, and Dr. Ludvig Hektoen, with those of Case VII. Cases V and VI occurred in the Cook County Hospital service of Dr. W. F. Knoll, by whom the histories were kindly placed at my disposal. I desire to thank all these gentlemen for their courtesy in thus enabling me to get together these interesting cases.

CASE I. *Traumatic rupture of the bladder; peritonitis; celiotomy; death.*—John D., aged twenty-eight, a well-developed, muscular man, was admitted to Cook County Hospital on the afternoon of May 31, 1889, in the service of Dr. T. J. Conley. He gave

¹ Read at the meeting of the Pathological Section of the Chicago Academy of Sciences, December 1, 1892.



a clear, intelligent history of having been kicked in the supra-pubic region by a horse, twenty-four hours before. At that time he had not been intoxicated. He had urinated four hours before receiving the injury. Since then he had not passed a drop of urine himself, though a physician had withdrawn by catheter a "cupful of bloody water" five hours before the patient entered the ward. He complained of quite severe abdominal pain and of nausea. He was vomiting when admitted, the face was flushed, the skin not clammy, the mind clear. The breathing was rapid and almost entirely thoracic; the pulse 120, regular, quick, and the temperature 100° F. The abdomen was moderately tympanitic, the muscles tensely contracted, and there was an absence of hypogastric dulness. There was neither desire nor ability to expel urine. By the catheter a few drops of bloody fluid were obtained, and pressure over the abdomen forced out about a dram more. With the sound, no abnormal opening in the bladder could be discovered. Rectal examination revealed no fracture of the pelvic bones: Intra-peritoneal rupture of the bladder was diagnosticated, and as a confirmatory test 600 c.c. of boric acid solution were injected through the urethra, of which but 100 c.c. were recovered. Though previous to the introduction of the solution of boric acid, a Barnes dilator had been introduced into the rectum, no increase in dulness was noted in the hypogastrium, such as would have been found had the bladder held the fluid and been lifted against the anterior abdominal wall by the dilator.

Twenty-three hours after the reception of the injury, abdominal section was made and a linear rent in the posterior vesical wall near the fundus was repaired by suture. The parietal and visceral peritoneum showed injected vessels, loose adhesions, and an

abundant flaky fibrinous exudate. Abdominal flushing and drainage were carried out.

Urine was voided voluntarily five hours after the operation, and again five hours later. During the remaining twelve hours of life no urine was obtained by voluntary micturition or by the catheter. Death followed at eight o'clock on the morning of June 1st, forty-nine hours after the injury, and twenty-four after the operation.

Immediately after death the abdominal wound was opened. The stitches in the bladder were almost concealed from view by the exudate covering the line of the wound. The bladder held without leakage a pint of water. There were general peritoneal adhesions, and there was a small amount of slightly fetid fluid in the lowest portion of the abdominal cavity.

CASE II. *Traumatic rupture of the bladder; celiotomy; septic peritonitis; death.*—(Service of Dr. Bayard Holmes, Cook County Hospital.) M. F., an adult male, on the morning of July 10, 1889, while intoxicated, fell a distance of twelve feet, striking on the feet and left hand, and cutting the chin. He immediately felt considerable pain in the abdomen, which grew steadily more severe. He evacuated both bladder and rectum an hour after the injury, but did not notice the character of the excreta. The patient was sent by the examining physician to the ward for minor surgery, where the wounds were attended to by the nurse. In the evening the interne, noticing a tense and tender abdomen and dulness in the hypogastric and left inguinal regions, inserted a catheter and drew off a pint and a half of dark bloody fluid, which flowed in quite a steady stream and coagulated soon after withdrawal. At 10 P.M., under ether, no pelvic fracture was detected. A sound passed by the urethra

revealed a roughness in the fundus of the bladder. Celiotomy was performed, and a ragged rent, two inches in length, was discovered in the fundus, a little to the right of the median line, and just beyond the place of deflection of the peritoneum over the bladder. The lower half was sutured, and the margins of the anterior half were stitched to the lower angle of the abdominal wound. A rubber drain was inserted into the bladder.

In spite of what seemed to be delirium tremens, and a general septic peritonitis (the latter confirmed by autopsy), the patient lived four and a half days after the operation.

CASE III. *Traumatic rupture of the bladder; peritonitis from catheter-infection; death.*—On the evening of May 18, 1890, there was brought to Dr. C. W. Earle's hospital for inebriates, a man who for several days had been drinking heavily. About ten o'clock on that evening, I saw him and had no suspicion of anything more than ordinary drunkenness. The next morning the nurse said the patient had complained of severe pain during the night, and had often gone to the closet to urinate. The man, who was now sobering up, could not remember when he had last urinated, though he said that during the night he had frequently felt the desire to empty the bladder. Suspecting retention of urine, I introduced a metal catheter (about No. 10, American), which passed readily, meeting no obstruction, and there escaped a dark, reddish fluid, containing, as shown by microscopic examination, a large number of red blood-corpuscles. The stream was an interrupted one, varying in the distance it was thrown from the catheter's end with the movements of respiration, and thrown, when the muscles of the abdominal wall were brought into play in the efforts of the patient to force out the fluid, for at least four

or five inches. In this way, and by pressure upon the abdominal wall, something more than a quart of bloody fluid was withdrawn. There was dulness on percussion, now only faintly preceptible in the flanks, while before it had been noticeable near the median line, though before catheterization there had been no flatness on percussion made out, nor any rounded mass, such as the distended bladder gives rise to.

The history of the patient was valueless, as he remembered nothing of the events of the preceding days. The remains of a recent bruise were discovered on the right knee, and a friend reported that on the 17th a physician had been called, who prescribed for severe abdominal pain. No history of injury was obtainable. The temperature at the time of catheterization was 99° F., and the pulse 120. Rupture of the bladder was diagnosticated. A consultant advising against operation, the patient was put on stimulants, and kept quietly in bed.

The urine was frequently drawn by the nurse and always escaped when the patient brought the abdominal muscles into play, or when pressure was made over the abdomen, both of which actions caused no pain. The temperature never rose as high as 100° F. Gradual failure in strength occurred, and the patient died on the morning of May 21st, fifty-four hours after admission to the hospital and about four days after having been seen by the physician who prescribed for the severe abdominal pain.

A post-mortem examination was made twelve hours after death. The skull was not opened, and examination of the chest was negative. About one pint of clear, blood-tinged fluid was found free in the abdominal cavity. The visceral and parietal peritoneum presented a normal naked-eye appearance, except in the lower abdomen, where, in the

most dependent position as the body lay on the back, *i. e.*, next the posterior wall of the abdomen, there were injection of vessels and a very few loose adhesions between the coils of the intestines, and a slight amount of fibrinous deposit. The posterior wall of the bladder showed a gaping wound, with irregular edges, extending from above downward and to the left, over two inches, and involving all the coats of the viscus. Other organs gave negative results, save that one kidney showed the changes incident to chronic interstitial nephritis.

CASE IV. *Extra-peritoneal rupture of the bladder; abscess; death.*—The patient was admitted to Cook County Hospital moribund, with no history obtainable, save that he had been ill for several days with pain in the lower abdomen. He died in a few hours, no ante-mortem diagnosis having been made. The autopsy showed extra-peritoneal rupture of the bladder and localized suppuration.

CASE V. *Fracture of the pelvic bones; extra-peritoneal and intra-peritoneal rupture of the bladder; death.*—(Cook County Hospital, service of Dr. W. F. Knoll.) Maggie M., twenty-eight years old, fell thirty feet on January 13, 1891. Immediately brought to the ward, she was unconscious, breathing heavily and rapidly, bleeding from the ear, and with a feeble pulse. Three ounces of bloody urine were drawn by the catheter. But two-thirds of a solution of boric acid, injected into the bladder, could be recovered.

Incision over the arch of the pubis revealed laceration of the anterior wall of the bladder, and through this a laceration of the posterior wall could be diagnosticated. A comminuted fracture of the pubic bone gave a ready explanation of the damage to the bladder. Bloody fluid was extravasated into the pericystic cellular tissues and into the peritoneal

cavity. The wounds were repaired, the patient taking the anesthetic poorly. She never regained consciousness and died on the evening of the same day. No autopsy was permitted.

CASE VI. *Extra-peritoneal rupture of the bladder; operation; death on the fifth day.*—(Cook County Hospital, service of Dr. Knoll.) M. K., an adult, painter, was admitted February 10, 1891. A mass of iron had struck him on the left groin and left side of the pelvis. On admission the general condition was good. There was swelling along the line of Poupart's ligament on the left side, from the root of the penis to a point two inches above the anterior superior spine. There was inability to urinate. One ounce of bloody fluid was withdrawn by the catheter. Injection of solution of a boric acid caused increase in size of the swelling, and none of the solution was recovered.

Incision in the median line, as in supra-pubic lithotomy, showed a fracture of the body and ramus of the os pubis, extravasation of bloody urine and boric solution. As the seat of the rupture was out of reach, a lateral perineal incision was made and a rent at neck of the bladder was discovered.

The patient lived for five days, with rapid pulse, averaging 130, and a temperature ranging from 99° F. to 102° F. He complained of but little pain; the wounds were of a healthy appearance, the dressings always freely soaked with urine. On the morning of the fifth day a severe chill occurred, with rise in temperature, delirium, collapse, and death at 10.30 P.M. No autopsy was permitted.

CASE VII. *Traumatic intra-peritoneal rupture of the bladder complicated by uterine fibroids and cerebral hemorrhage; death after nine days; no peritonitis.*—A woman, thirty-five years old, suffering from severe pain in the head, was admitted to hospital on June

11, 1892. During the afternoon she had a fainting spell, and at about this time was kicked in the abdomen and beaten over the head with a broom by her drunken husband. On June 14th a physician found her suffering with severe headache and unable to answer questions. On the following night she walked about the room screaming, and on the 20th she died, without the development of any new symptoms.

The post-mortem examination, made twenty-four hours after death by Dr. Hektoen, who reports the case, showed no external mark of violence. The abdominal cavity contained three and one-half quarts of clear, limpid fluid with a urinous odor. The peritoneum was smooth, shining, and showed no evidence of peritonitis.

In the posterior wall of the urinary bladder, near the fundus, was a transverse tear, one and one-half inches long, with ragged margins free from any signs of inflammation, and showing on the mucous surface a few superficial continuations at the end of the total tear; the viscus was empty, the mucous membrane smooth, the walls apparently thin. The uterus contained three sub-serous fibro-myomata, the largest of a diameter of four inches, the pelvis being filled up. Heart, lung, kidneys, liver, spleen, showed no changes bearing upon this lesion.

In the left frontal lobe of the brain was a blood-clot, the size of a hen's egg, in a cavity lined with softened yellowish detritus. The pia mater in the longitudinal fissure was infiltrated with blood; the brain otherwise healthy.

REMARKS.—Out of a total of about eight thousand surgical cases in Cook County Hospital since 1889, five have been proved to be instances of traumatic rupture of the bladder. Two of the seven cases

here reported were not diagnosticated before death. This frequency of occurrence and failure to diagnose render it probable that the accident happens more frequently than is generally supposed. The *St. Bartholomew's Hospital Report* for 1869-75 mentions but two instances of injury to the bladder out of a total of 16,711 surgical cases.

The cases here recited are instructive, not so much from the point of treatment as from that of diagnosis. Incision and repair of the wound in intra-peritoneal rupture, and repair of the wound when possible, with drainage, in extra-peritoneal rupture, are probably regarded to-day as the rational treatment.

The history of a trauma can usually be obtained. If the patient himself, on account of intoxication, cannot remember an injury, bruise-marks can often be discovered, as in Case III, pointing to blows or falls. These may, however, be lacking, as in Case VII. In Case I, too, there was discovered only a slight area of subcutaneously extravasated blood when the abdominal incision was made. In rupture of the healthy bladder traumatism is to be assumed. When a weakness of the coats of the viscus exists, as from tuberculous or malignant disease, or from inflammatory changes in the wall of the bladder, or in its neighborhood, over-distention without trauma may cause rupture. Some, as Pousson, believe that an over-distended healthy bladder may rupture spontaneously. That drunkenness is an important etiologic factor is well known. It furnishes the abundant secretion of urine; a parietic, and consequently distended, bladder, which rises

above the pelvic brim, where it is exposed to injury ; and a relaxed abdominal wall, so that the force of any blow, to which a drunken man is especially liable, be it from a kick, a heavy weight, or a fall, comes with unchecked vigor upon the viscus with walls tightly stretched. In Case VII, as Dr. Hektoen points out, the enlarged uterus constituted a resisting body against which the bladder would be forced by the kick. A slighter blow might here suffice to cause rupture, and especially as the bladder, though not containing much urine, would be lifted by the uterus high in the pelvis.

Two of these seven cases occurred in intoxicated persons. In three, intoxication was not present. In one, the history in this respect is lacking. In Case VII rupture occurred probably some time after a cerebral hemorrhage, when the bladder can easily be assumed to be distended.

Drunkenness is not only an important element in etiology, but it tends to mask otherwise plainly-marked symptoms. The severe pain and the phenomena of shock, so commonly present, may, in an intoxicated person, be but slightly, if at all, marked. The inability to urinate in response to urgent desire, which condition is so characteristic of rupture in a person with unclouded intellect, is often overlooked in these cases by the patient, and, consequently, by the physician. When it is discovered the physician naturally passes the catheter and obtains no urine, or bloody urine.

I desire to call attention to one fact very strikingly illustrated by two of these cases. In Cases II and III there was a free discharge of fluid on the intro-

duction of the catheter. In Case II, Dr. H. F. Lewis, who reports it,¹ says: "The catheter drew about a pint and a half of dark, bloody fluid, which flowed normally after withdrawing the point a short distance and re-introducing." In Case III, a quart of bloody fluid was withdrawn in a full stream, which, when the patient strained, was thrown four or five inches from the end of the catheter. The explanation of this occurrence seems to be that in both these cases the rent in the bladder wall, as was shown by ante-mortem and post-mortem examination, was so large that the catheter passed directly into the abdominal cavity, which contained the fluid. Pressure was made by voluntary contraction of the abdominal walls and diaphragm, just as is so often done by a patient when tapped for abdominal ascites. The diaphragm and abdominal muscles were readily made to contract, because at this time, at least in Case III, there was no peritonitis, causing the involuntary fixation of these muscles in order to avoid pain. This point, that when the rent is large, and especially when there is no peritonitis, bloody urine may be obtained in quantity and in a stream, seems worthy of careful consideration, as it is generally stated that no urine, or only a few drops of bloody urine, can be obtained by the catheter. Greig Smith, for instance, in his excellent article, says: "Only blood, or blood and urine, escapes in drops, and the patient gets no relief" (from catheterization).² The fact that in Case III the urine

¹ The North American Practitioner, September, 1889.

² Abdominal Surgery, 4th ed., p. 752.

flowed, decided, at a consultation, against the diagnosis of rupture of the bladder, and hence against operation.

That peritonitis is not an inevitable consequence of rupture of the bladder is not only known by *à priori* reasoning, on the ground that aseptic urine will not produce peritonitis, and from well-known experiments, but is also clearly shown by these cases. Case III had no sign of peritonitis until he had been catheterized, and this by at least five different persons, and with poor or no antiseptic precautions. The autopsy showed commencing peritonitis in one place only, and that the most dependent portion of the abdominal cavity, when the patient was in the dorsal position, which he kept after the catheterization. Before that he had been up and down, and urine must have bathed all parts of the peritoneum; yet no peritoneal inflammation existed except where the infection by the catheter had taken place.

No case is more positive and instructive, however, than Case VII; here no catheterization had been performed, urine had accumulated in the abdominal cavity for nine days, and yet there was no peritonitis.

We can explain on no other ground than non-existence of early peritonitis the case of Harrison, in which the patient on the day after the rupture walked three miles to be catheterized, and kept at work three days more, emptying the bladder voluntarily. Only on the fourth day did symptoms of peritonitis develop, with death on the eighth day. There were local peritonitis and sac-formation by adhe-

sions.¹ Gillespie reports a case in which, three days after the injury, a patient entered the hospital to be catheterized. Death occurred ten days later. The autopsy showed a ruptured bladder, intra-peritoneal extravasation of urine, and slight peritonitis.

The importance of being careful in catheterizing a patient with suspected damage to the bladder is emphasized by these cases. A septic catheter used for diagnosis may spoil the favorable result of a faultlessly aseptic celiotomy for the repair of the bladder-wound.

In four of these cases the injection of a solution of boric acid, with failure to recover a large part of the fluid injected, confirmed the diagnosis. The exploration of the hypogastrium in all these cases failed to reveal the physical signs of a distended bladder. When enough fluid is injected in this way the ordinary physical signs of abdominal ascites are obtained. In Case VI, the fluid escaping through an extra-peritoneal tear caused the swelling along Poupart's ligament to increase in size. Sterilized water would answer the mechanical purpose and avoid the risk of poisoning from retention and absorption of the boric-acid solution, and would not be as irritating to the sensitive peritoneal pericystic tissue. Keen² advocates, as an aid in establishing the diagnosis of intra-peritoneal rupture of the bladder, the introduction of sterilized air *per urethram*, after the analogy of the Senn rectal insuff-

¹ Quoted by Ultzmann : Die Krankheiten der Harnblase, 1890 p. 70.

² Annals of Surgery, September, 1890.

flation. This should give positive aid in extra-peritoneal rupture, if there be swelling, tympanites on percussion, and the tissues be emphysematous on palpation. It might have the advantage, too, over the fluid, of escaping through small openings that were closed against fluid by a valve-like flap of membrane, inflammatory exudate, or hernial protrusion of intestine into the bladder.

The attempt has not been made to discuss at length the diagnosis of rupture of the bladder, but rather to give emphasis to some points that are exemplified by these cases.

The following conclusions seem warranted by the observation of the cases reported :

1. The absence of a history of a trauma or of external evidence of violence in the supra-pubic regions does not exclude traumatic rupture of the bladder.

2. When the rent is large, urine may escape from the catheter in a full stream.

3. When the rent is small and covered by free exudate, urine may likewise escape normally. (Ultzmann.)

4. Peritonitis does not necessarily follow rupture of the bladder.

5. This being so, in a suspected case extreme caution as to asepsis should be observed in catheterization.

6. As an aid in diagnosis the injection of a measured amount of warm sterilized water is in all cases to be tried, the abdomen subjected to careful physical examination before and after the injection, and the amount recovered by the catheter carefully noted. A Barnes dilator in the rectum will aid in

lifting the bladder out of the pelvis against the abdominal wall.

7. Hydrogen gas or air may be substituted for water.

8. All injections should be under moderate pressure, as by high pressure an incomplete rupture might easily be converted into a complete one.

9. In all cases of fracture of the pelvic bones rupture of the bladder is to be sought, and *vice versa*, in all cases of rupture of the bladder examination per rectum, etc., must be made for fracture of the pelvis.

10. Extra-peritoneal rupture may be complicated by intra-peritoneal rupture. (See Case VI, in which apparently a spicule of bone made a through-and-through perforation.)

11. Supra-pubic cystotomy or opening of the abdominal cavity in suspected extra-peritoneal rupture is justifiable in order to confirm the diagnosis and to locate the point of rupture, so that drainage can be properly applied.¹

¹ On the Value of Exploratory Laparotomy in Suspected Extra-peritoneal Rupture. *Vide* Cabot: Boston Med. and Surg. Journ., October 15, 1891.

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